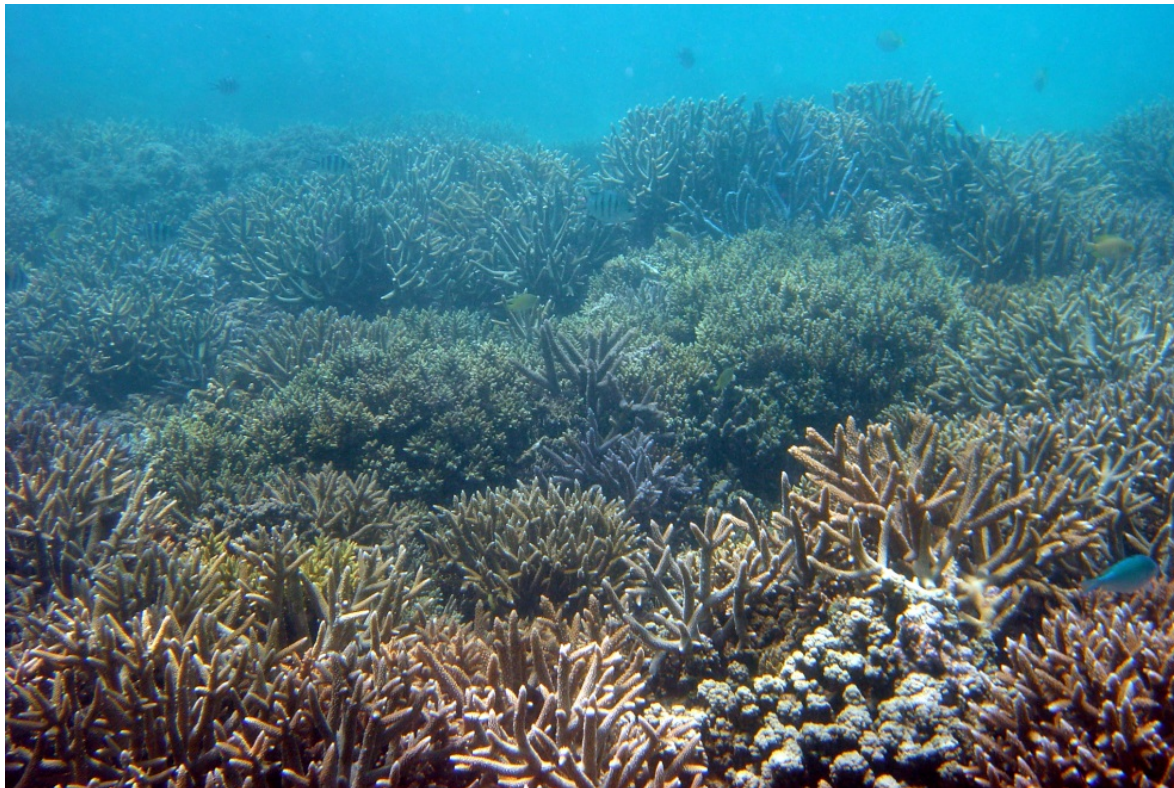




CORAL

COral Reef Airborne Laboratory



Principal Investigator:
Eric J. Hochberg (BIOS)

Project Scientist:
Michelle Gierach (JPL)

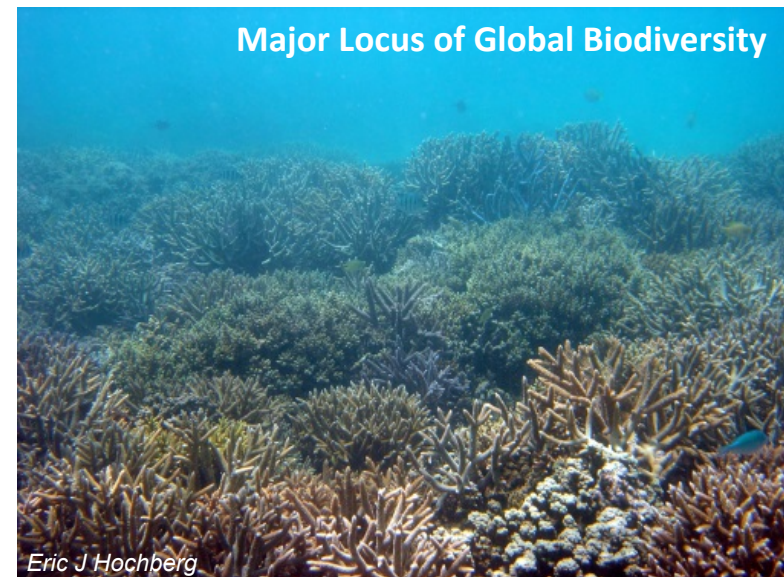
Project Manager:
Ian McCubbin (JPL)

EVS-2 Mission Manager:
Jennifer Olson (LARC)

Program Scientist:
Paula Bontempi (NASA HQ)

Importance of Coral Reefs

Coral reef ecosystem goods & services valued at ~\$400 billion annually



Overfishing & Destructive Fishing



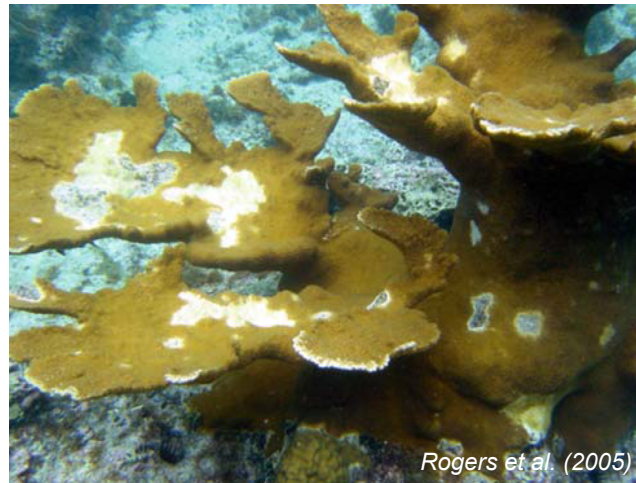
Coastal Development & Pollution



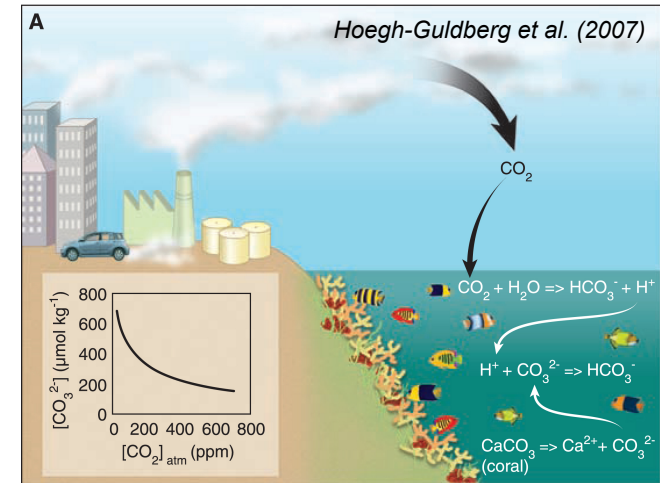
Coral Bleaching



Disease

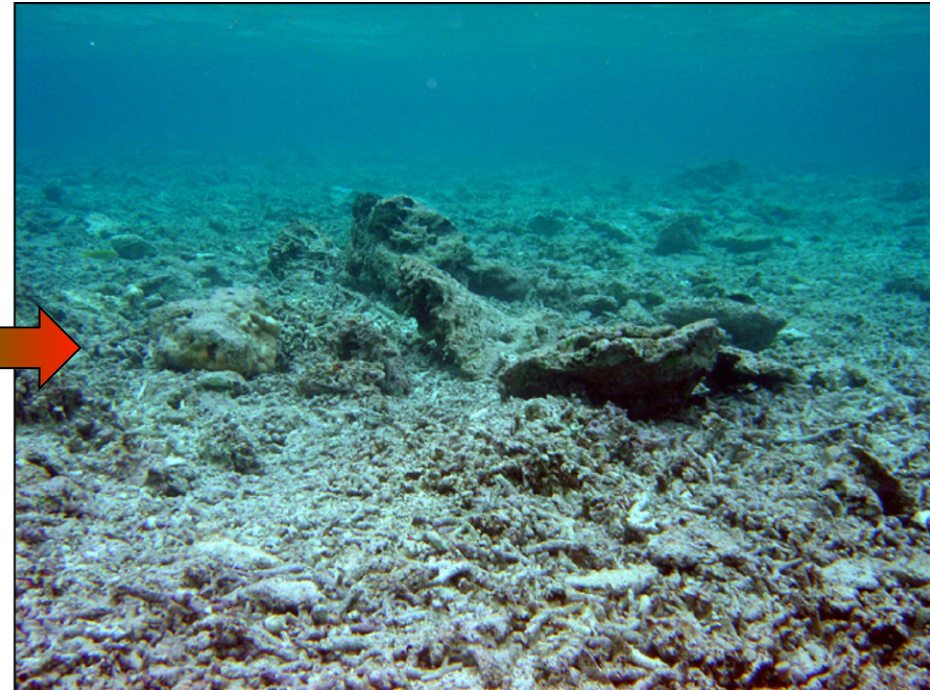
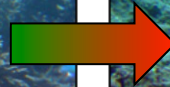


Ocean Acidification



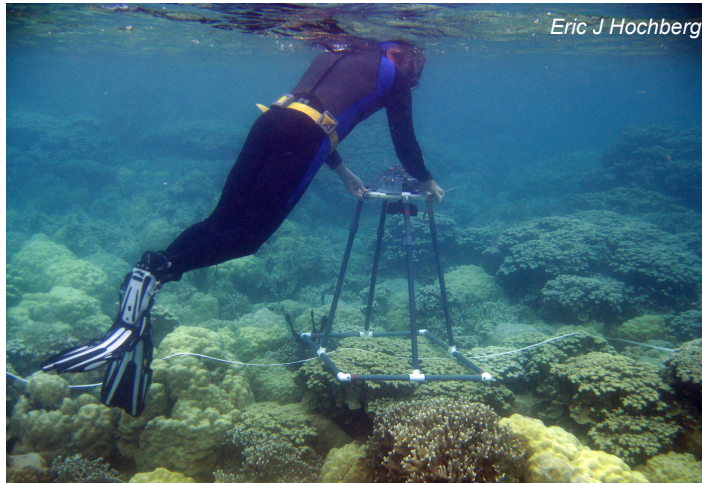
Among others...

Reef degradation manifests as ecological phase shift from...

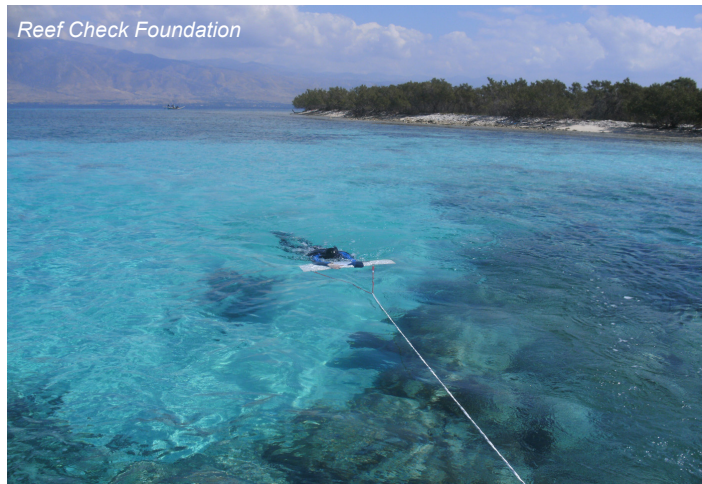


...diverse, productive, and coral-rich, to...

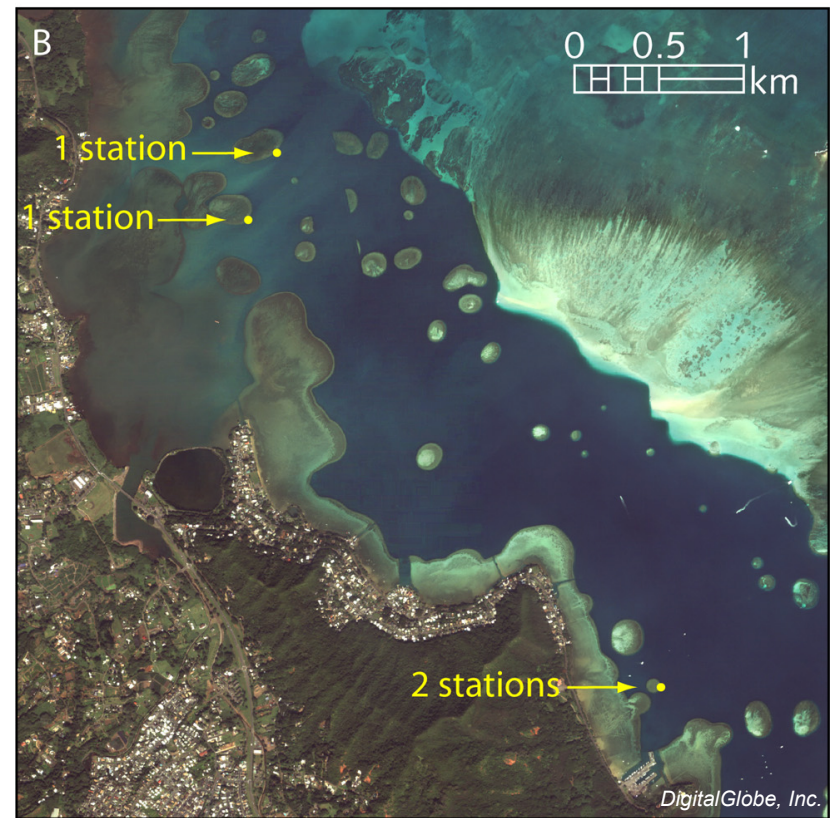
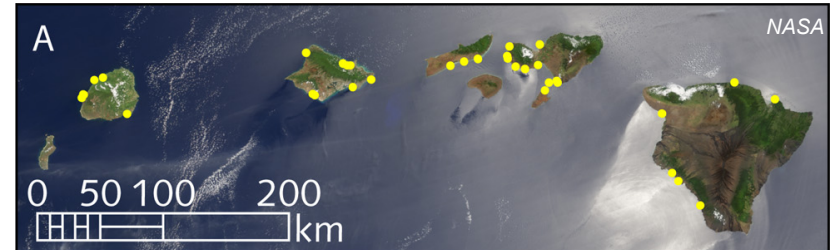
...low diversity, low productivity, and coral-poor.



Transects: detailed, laborious, small footprint



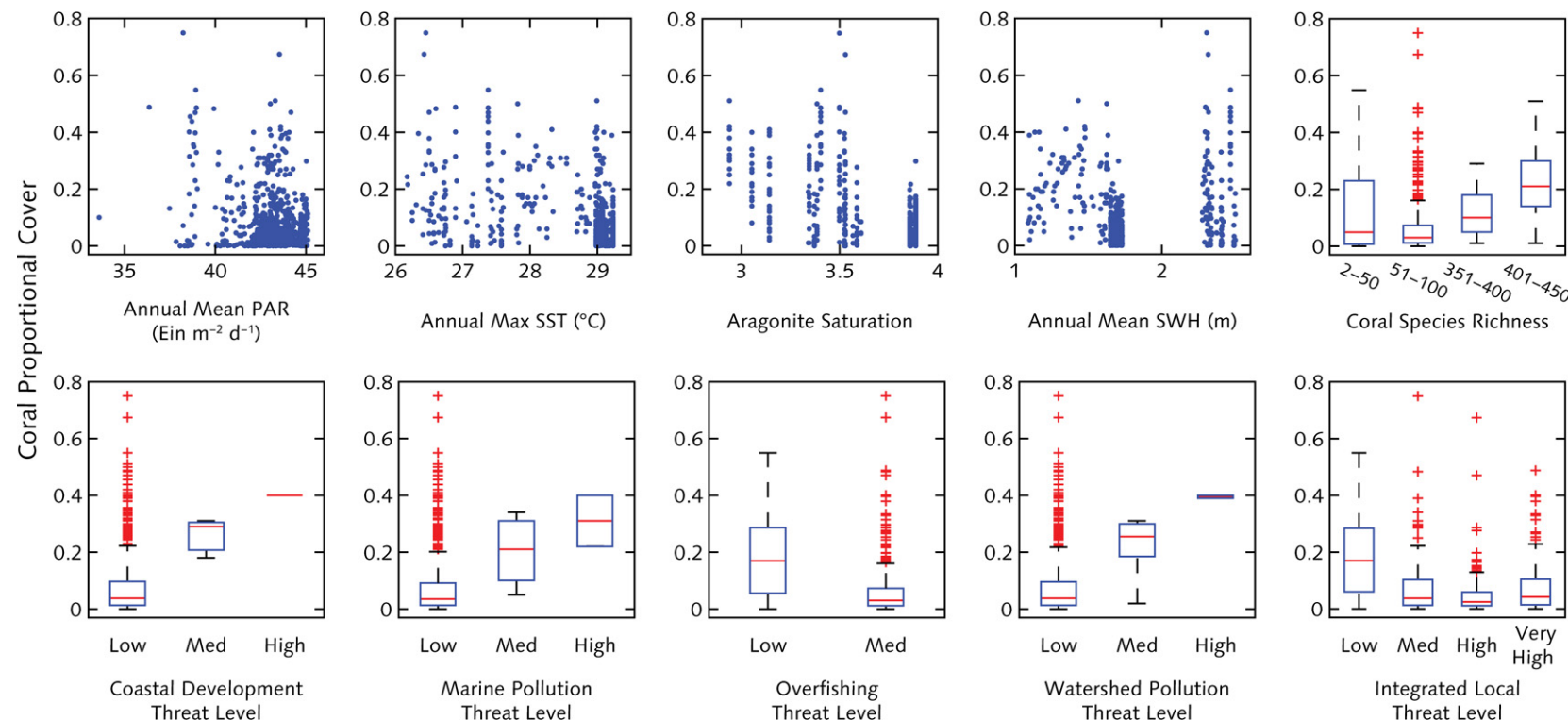
“Manta-Tow”: quick, semi-quantitative, larger footprint



Most surveys are very sparse, undersampling reef area across local and regional scales

Coral Reef Condition

The most common metric for reef condition is proportional cover of benthic types, primarily coral.



Existing survey data (US Caribbean, Hawaii, Great Barrier Reef) do not follow expected trends with respect to environmental factors. For example, coral cover should *increase* with aragonite saturation and *decrease* with marine pollution.

Either our understanding of reefs is incorrect, or our data are inadequate (low density, mismatched scales). Or maybe both.



CORAL Objectives

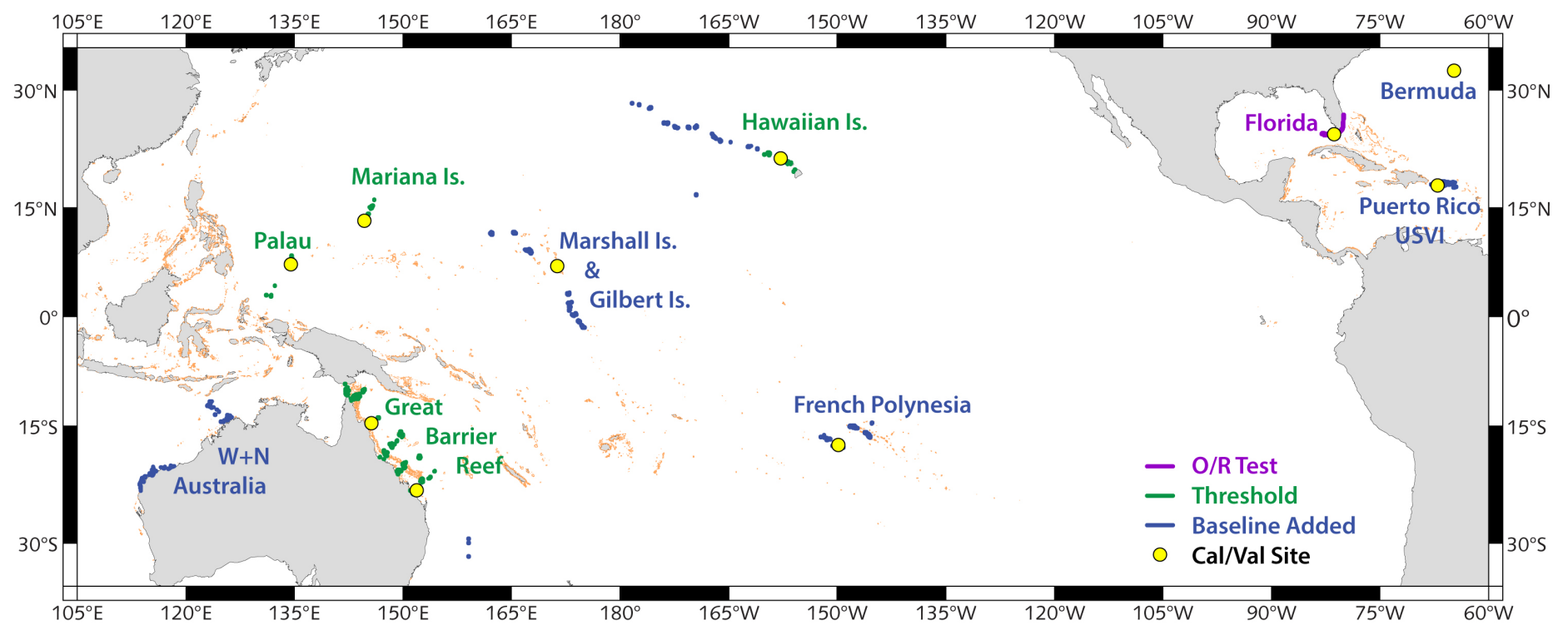


Overarching Science Question (Threshold)

Q1. What is the relationship between coral reef condition and biogeophysical forcing parameters?

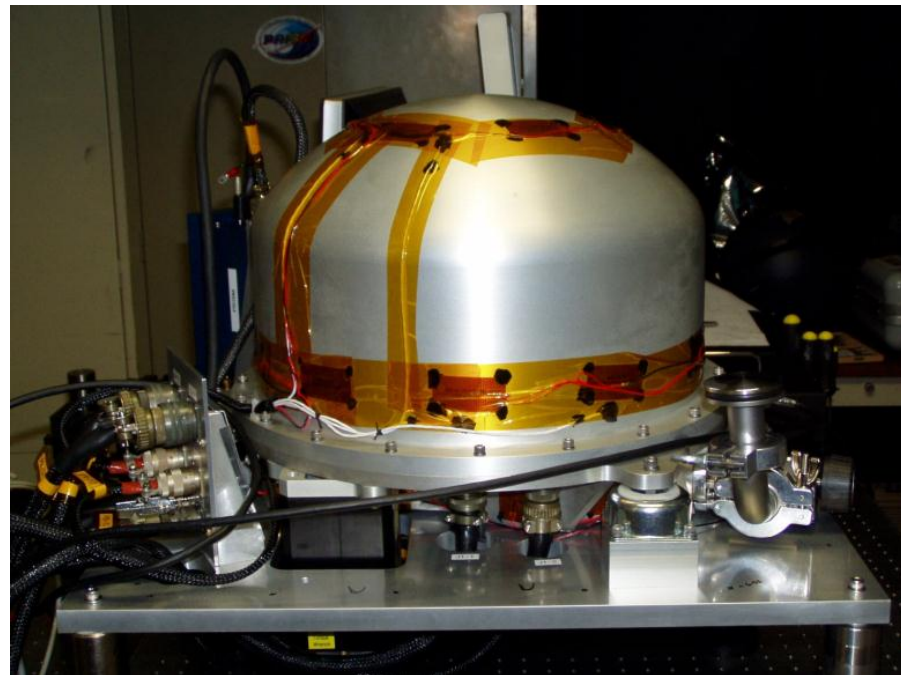
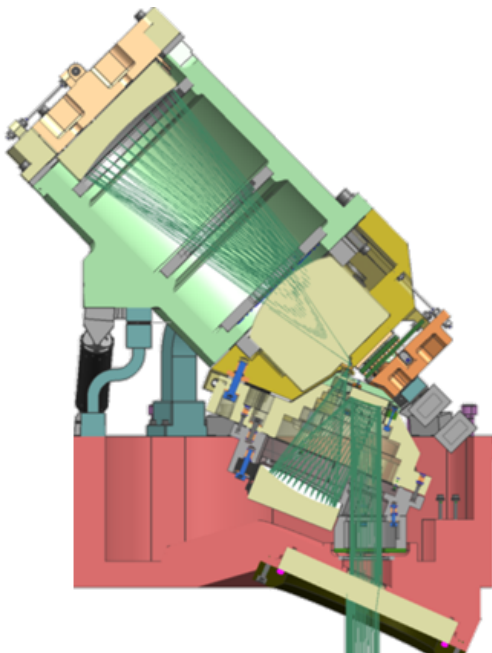
CORAL Science Objectives (Threshold)

- O1. Make high-density observations of reef condition for a large fraction of world's reef area (green in map below, 10^3 more than current, in situ observations).
- O2. Model relationship between reef condition and biogeophysical forcing parameters.

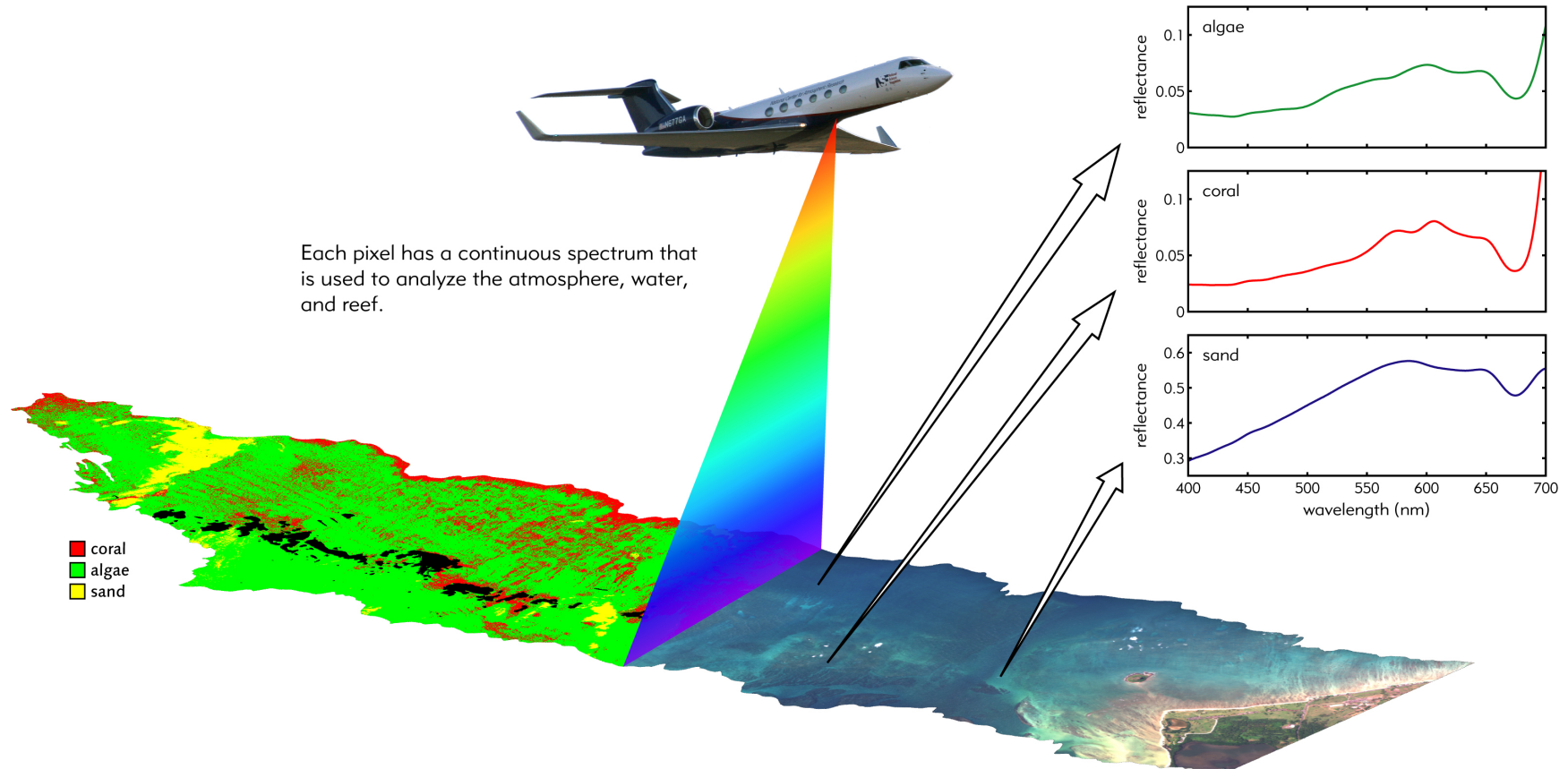


CORAL Technology: PRISM

| Observables/Parameter | CORAL Requirements | PRISM Performance |
|---|----------------------|-------------------------|
| Spectral Range | 400-800 nm | 350-1050 nm |
| Spectral Sampling | ≤ 10 nm | 2.85 nm, 1242 & 1608 nm |
| Radiometric SNR | > 300 @ 400-800 nm | > 600 @ 400-800 nm |
| Polarization Sensitivity | $\leq 1\%$ | $< 1\%$ |
| Spectral Uniformity <i>Cross-Track, IFOV Mixing</i> | $> 90\%$, $< 10\%$ | $> 95\%$, $< 5\%$ |
| Spatial Resolution | ≤ 10 m | @28kft ≤ 8 m |



Airborne platform (NSF G-V and/or NASA ER-2)

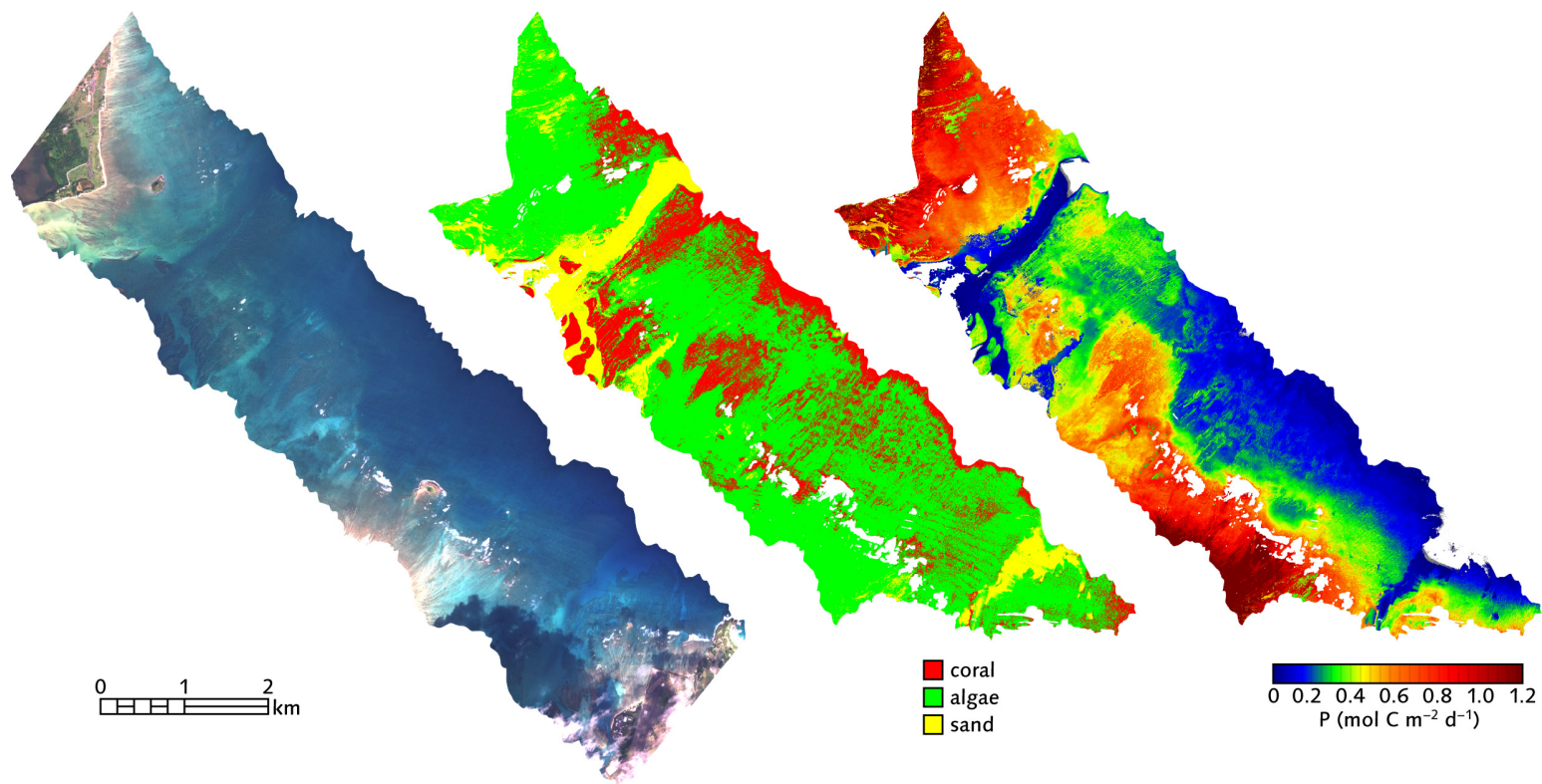


PRISM records the intensity of the wavelengths for each pixel in the scene. The spectral “signature” is used to identify reef composition (coral, algae, sand) and model primary production.

Original
Image

Reef
Composition

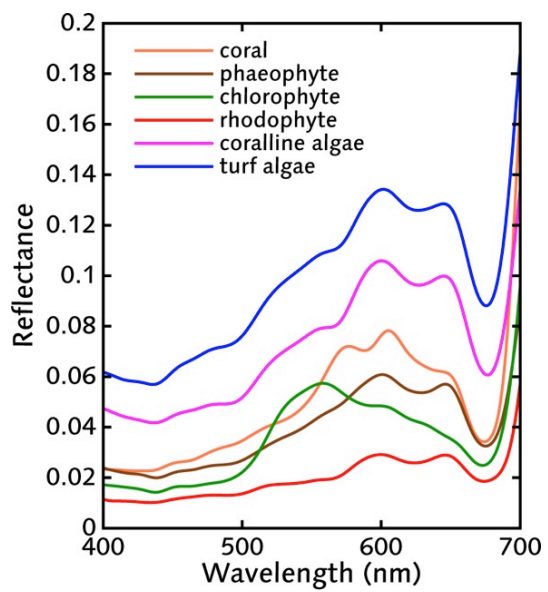
Reef
Productivity



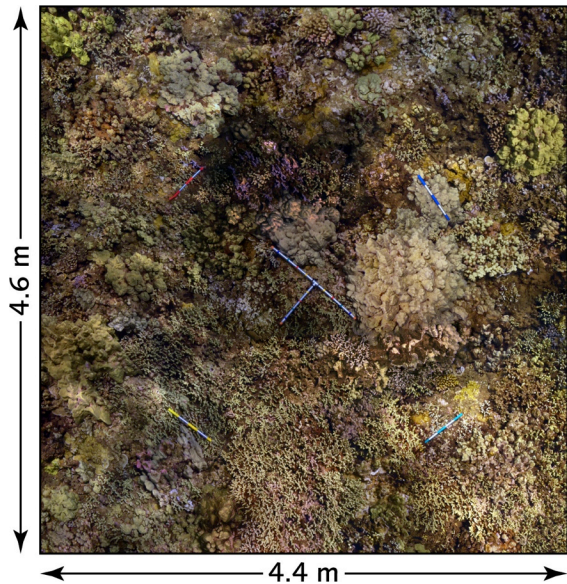
CORAL's first objective is to generate these products for all study areas.
CORAL's second objective is to analyze these products in relation to biogeophysical forcing parameters.

The result will be a new understanding of how environment shapes whole reef ecosystems, which is vital to their conservation.

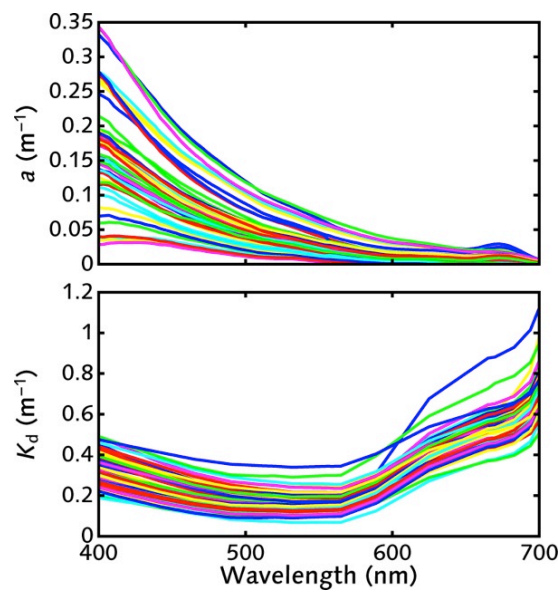
Benthic Reflectance



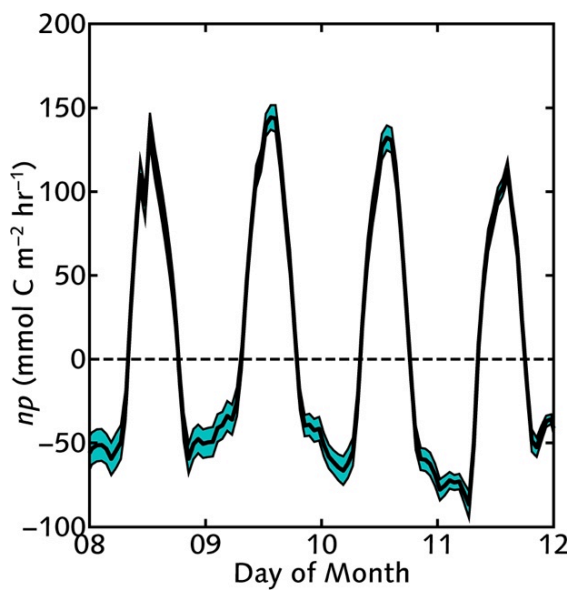
Benthic Cover



Water Optical Properties



Benthic Productivity





CORAL Science Team



| | Team Member | Org. | Roles & Responsibilities | |
|--|-------------------------|-------|--------------------------|---|
| Calibration/ Validation | Dr. Heidi Dierssen | UConn | Co-I | Optical calibration/validation (Level 2) |
| | Dr. ZhongPing Lee | UMB | Co-I | Optical calibration/validation (Level 2) |
| | Dr. Eric Hochberg | BIOS | PI | Benthic cover calibration/validation (Level 3) |
| | Dr. Steve Dollar | UH | Co-I | Benthic cover calibration/validation (Level 3) |
| | Dr. Bob Carpenter | CSUN | Co-I | Benthic community productivity & calcification calibration/validation (Level 4) |
| Data Products | Dr. Robert Green | JPL | Co-I | Digital Numbers (DN) to benthic composition (Levels 0-3) |
| | Dr. Pantazis Mouroulis | JPL | Co-I | Digital Numbers (DN) & radiance products (Levels 0-1) |
| | Dr. Bo-Cai Gao | NRL | Co-I | Atmospheric & glint correction (Level 2) |
| | Dr. ZhongPing Lee | UMB | Co-I | Water column correction (Level 2) |
| | Dr. Eric Hochberg | BIOS | PI | Benthic cover product; primary productivity & calcification products (Levels 3-4) |
| | Dr. Stéphane Maritorena | UCSB | Co-I | Primary productivity & calcification products (Level 4) |
| Science Facilitators at International Locations | Dr. Patrick Colin | CRRF | Co-I | Palau liaison |
| | Dr. Stuart Phinn | UQ | Collaborator | Great Barrier Reef liaison |
| | Dr. Arnold Dekker | CSIRO | Collaborator | Great Barrier Reef liaison |

